

## **ABYSS Mission Archive Document**

This document archives content about the proposed ABYSS mission for ocean floor mapping.

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The ABYSS (Altimetric Bathymetry from Surface Slopes) mission will map the ocean floor 100 times faster and cheaper than ships can, by using a state-of-the-art radar altimeter on board the International Space Station.

NOAA, in partnership with the Johns Hopkins University Applied Physics Laboratory (JHU/APL), has submitted this proposal to NASA's ESSP (Earth System Science Pathfinder) program. A decision is expected in summer 2002.

# ABYSS

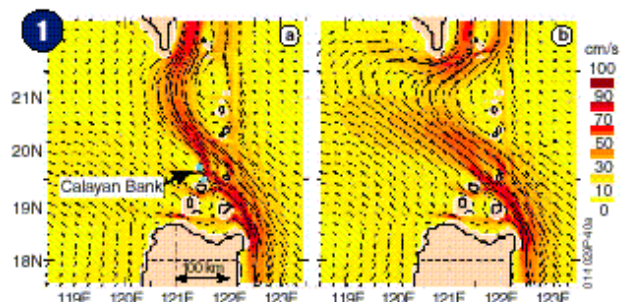
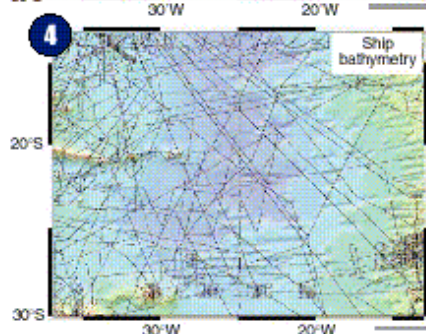
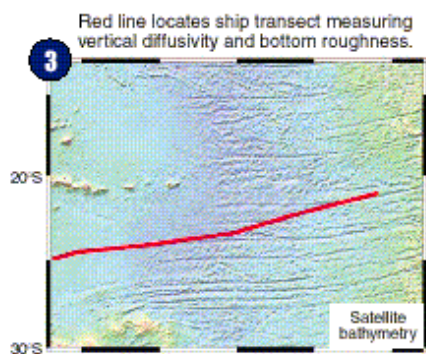
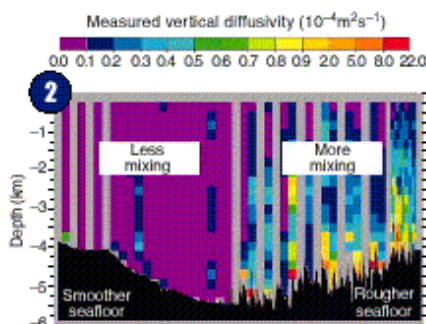
Altimetric Bathymetry from Surface Slopes

## Mission Statement

To map the small-scale bathymetry needed for NASA's Earth Science Enterprise research strategy.

## Bathymetry is Required

The global climate is directly affected by ocean circulation and mixing. Ocean currents are steered by bathymetry at spatial scales shorter than 20 km (1). Mixing, diffusion, and energy dissipation in the ocean are controlled by bottom roughness on scales shorter than 100 km (2). Bathymetry and roughness on these scales change from place to place due to variability in tectonic processes.



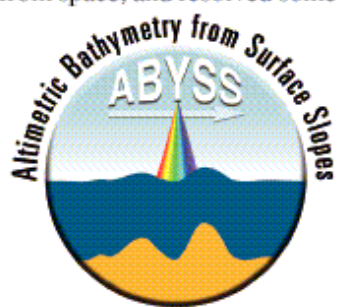
Correct current flow prediction requires inclusion of small bathymetric features (left).

## Science Objectives

- Resolve bathymetry to 6 km to model ocean's role in climate.
- Characterize variability in seafloor roughness and ocean mixing.
- Map variations in seafloor spreading and micro-plate tectonics.

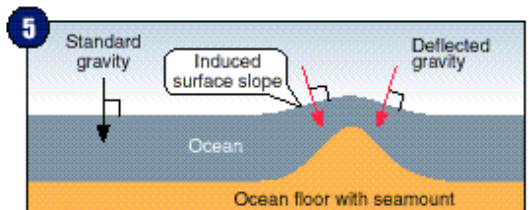
## A New Space Mission is Required

Existing satellite altimeter data have proved the technique and algorithms for measuring bathymetry from space, and resolved some larger-scale roughness changes (3), but have not captured the required scales. Conventional ship surveys can provide detailed bathymetry, but only over very small areas, and so have not resolved the global variations in roughness (4). Less than 1% of the deep ocean floor has been mapped sufficiently. ABYSS will provide the required resolution and coverage.



## Measurement Requirement

A one-time mission with one instrument, a precision space-based radar altimeter in a moderate inclination orbit to measure sea surface slopes (5) as small as  $1 \mu\text{rad}$  over the baseline 6-year mission. (Minimum mission is 3 years.)



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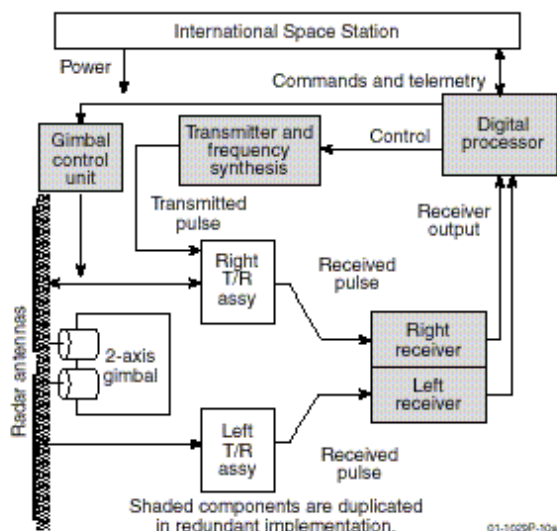
## Altimetric Bathymetry from Surface Slopes

## ABYSS is Low Risk Because

- The measurement concept and fundamental algorithms are proven.
- The instrument is flight-tested (NASA Instrument Incubator Program).

## ABYSS Implementation

ABYSS is proposed as an instrument on NASA's EXPRESS Pallet, transported to the International Space Station by the Space Shuttle. The ISS orbit geometry is ideal for ABYSS. The Johns Hopkins University Applied Physics Laboratory (JHU/APL) has developed a flight-proven delay-Doppler altimeter that can provide sufficient precision and gimbal control to deliver the required science data from the ISS, autonomously, in spite of ISS motions. ABYSS will be built at JHU/APL for the ISS, or for a spacecraft of opportunity.



### Radar Altimeter Parameters

Parameter	Value
Frequency	13.575 GHz, Ku-band
Average radiated power	4 W
Mass	171 kg
Power	177 W
Data rate	45 kbps

## ABYSS Complements Related Missions

- ABYSS provides required bathymetry that cannot be obtained with a conventional oceanographic altimeter, like that of Jason-1, because those altimeters have unacceptable orbits and precision.
- It adds knowledge of marine gravity anomalies with length scales of 6 to 200 km, an order of magnitude shorter than expected from GRACE or GOCE.

## ABYSS Emphasizes Science

	NASA Cost	Contributed	Total
Mission development			
Launch and mission ops			
Total launch vehicle and services			
<b>TOTAL</b>			

\* Includes reserves of \$xxM.

**ABYSS Project Team**

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\* Contributed Investigator

## ABYSS Schedule

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## International Space Station



## ABYSS Altimeter

